REMARKS/ARGUMENTS

The Applicants respectfully request reconsideration in light of the amendments set forth above and the arguments set forth below. Within the final Office Action, claims 1, 29, 30, 32, and 33 were rejected under 35 U.S.C. § 112, and claims 1-25 and 29-33 were rejected under 35 U.S.C. § 103(a). By way of the above amendment, claims 1, 29, 30, and 33 have been amended, claim 32 has been canceled, and claims 34-37 have been added. Accordingly, claims 1-25, 29-31, and 33-37 are now pending.

Rejections under 35 U.S.C. § 112

Within the final Office Action, it is stated that the amendments to claims 1, 29, 30 find no support in the provisional application from which the present application claims priority. Specifically, it is stated that there is no support in the provisional application for the limitation added to claims 1, 29, and 30: "a circulation line coupled to the work piece cavity configured to circulate a supercritical fluid through the work piece cavity." The Applicants did not specify that support for this limitation is found in the provisional application. Indeed, support for this element finds support in the original application as filed.

The element "a circulation line coupled to the work piece cavity configured to circulate a supercritical fluid through the work piece cavity" finds support throughout the Specification. Figure 5, for example, discloses a circulation line 152 coupled to a wafer cavity 112. The circulation line contains a circulation pump 140. In one example, referring to Figures 3 and 5, it is stated at page 10, lines 3-11:

> Once a desired amount of the solvent has been pumped into the pressure chamber 136 and desired supercritical conditions are reached, the carbon dioxide pump 134 stops pressurizing the pressure chamber 136, the first injection pump 159 stops pumping the solvent into the pressure chamber 136, and the circulation pump 140 begins circulating the supercritical carbon dioxide and the solvent in the fourth process step 58. . . . By circulating the supercritical carbon dioxide and the solvent, the supercritical carbon dioxide maintains the solvent in the contact with the wafer [contained the in the wafer cavity 112].

Because the Specification discloses "a circulation line coupled to the work piece cavity configured to circulate a supercritical fluid through the work piece cavity," the rejection under 35 U.S.C. § 112 should be withdrawn.

Claims 1, 29, and 30 have been amended to further recite a circulation line configured to circulate a supercritical fluid along the circulation line and through the workpiece cavity in a supercritical state, with the added language underlined. That portion of the Specification quoted above also supports these additional limitations.

Within the final Office Action, claims 32 and 33 are also rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Specifically, it is stated that "there is no support for a heater in the circulation line and of rigidity in the work piece cavity." The Applicants respectfully disagree with the rejection of claim 32. However, in an effort to advance prosecution, claim 32 has been canceled. Its rejection is now moot.

Claim 33 has been amended to recite that " the circulation line comprises a pump." Support for this limitation is found throughout the Specification. For example, Figure 5 discloses a pump 140 as part of the circulation line 152. For at least this reason, the rejection of claim 33 under § 112 should be withdrawn.

Rejections under 35 U.S.C. § 103(a)

Within the final Office Action, claims 1, 6-8, 15-17, 19-20, 25, and 29-33 were rejected under 35 U.S.C. § 103(a) as being anticipated by Bok *et al.*, "Supercritical Fluids for Single Wafer Cleaning," Solid State Technology, June 1992, at 117-120 ("Bok"), in view of JP 08206485 to Shigeru Ueno ("Ueno"). The Applicants respectfully disagree with these rejections.

Bok teaches a system for cleaning wafers using supercritical fluids. The system comprises a chamber that cleans a wafer by pulsating a wall of the chamber, thus varying its height. As stated in Bok, at page 118:

> During the cleaning cycle, the supercritical fluid is pulsated by a hydraulic mechanism. The lower chamber block is actually a thin-walled, stainless steel membrane, i.e., a diaphragm. The hydraulic fluid pressure changes the chamber height via elastic deformation of the diaphragm, i.e., the supercritical fluid pressure is varied according to the volume of the cleaning chamber.

At page 118, Bok also teaches "an expulsion cycle . . . to replenish the cleaning fluid with fresh fluid." Bok teaches cleaning a wafer by pulsating a wall of a chamber not by circulating a fluid through the cleaning chamber using a circulation line. Indeed, Bok does not teach any structure for a circulation line. Nor does Bok teach a chemical rinse and supply arrangement coupled to a circulation line as described in the Specification.

It is stated within the final Office Action that Bok does not disclose a circulation line to circulate supercritical fluid within the processing cavity. However, it is further stated within the final Office Action that "Bok teaches an expulsion cycle to bring fresh fluid. Recirculation merely does this on a continuous basis." Contrary to the assertion in the final Office Action, expulsion is different from recirculation. The two require different structures. Recirculation requires additional or different elements, such as a circulation line, filters, heaters and the like. Expulsion does not require any of these. Bok does not teach a recirculation line of any kind, let alone one as recited in claims 1, 29, and 30.

Figure 1 in Ueno discloses a cleaning tank 1 coupled to a circulation passage 7. The circulation passage 7 contains a circulation machine 2 for circulating a supercritical fluid. Neither Figure 1 in Ueno nor the Abstract specifically teaches that a supercritical fluid is circulated along the circulation passage 7 and through the cleaning tank 1, all while in a supercritical state. Furthermore, Ueno does not teach a chemical rinse and supply arrangement coupled to a circulation line as described in the Specification.

Claim 1 recites an apparatus for supercritical processing of a workpiece. The apparatus comprises a transfer module having an entrance; a supercritical processing module coupled to the transfer module, the supercritical processing module having a workpiece cavity for holding the workpiece during high pressure processing; a non-supercritical processing module coupled to the transfer module; a transfer mechanism coupled to the transfer module, the transfer mechanism configured to move the workpiece between the entrance, the supercritical processing module, and the non-supercritical processing module; a circulation line coupled to the workpiece cavity and configured to circulate a supercritical fluid along the circulation line and through the workpiece cavity in a supercritical state. During circulation, the supercritical fluid remains in a supercritical state as it travels along the circulation line and through the wafer cavity. The structure recited in claim 1 does not require that the processing fluid be continuously brought to a supercritical state, then brought to a non-supercritical state (for example, to remove contaminants), and again brought to a supercritical state. Neither Bok, Ueno, nor their combination teaches or suggests a circulation line coupled to the workpiece cavity and configured to circulate a supercritical fluid along the circulation line and through the workpiece cavity in a supercritical state, as recited in claim 1. For at least this reason, claim 1 is allowable over Bok, Ueno, and their combination.

Claims 6-8, 15-17, 19, 20, 25, 31 and 33 all depend from claim 1. As described above, claim 1 is allowable. Accordingly, claims 6-8, 15-17, 19, 20, 25, 31, and 33 are all also allowable as depending on an allowable base claim.

Claim 29 recites an apparatus for supercritical processing a workpiece. The apparatus comprises means for transferring the workpiece configured to transfer the workpiece into a transfer module; means for supercritical processing having a workpiece cavity and configured such that in operation the means for transferring transfers the workpiece to the means for supercritical processing and further such that in operation the means for supercritical processing processes the workpiece within the workpiece cavity; means for non-supercritical processing configured such that the means for transferring transfers the workpiece to the means for non-supercritical processing and further such that the means for non-supercritical processing processes the workpiece; and means for circulating a supercritical fluid along the means for circulating and through the workpiece cavity in a supercritical state. As described above, neither Bok, Ueno, nor their combination teaches or suggests means for circulating a supercritical fluid along the means for circulating and through the workpiece cavity in a supercritical state, as recited in claim 29. For at least this reason, claim 29 is allowable over Bok, Ueno, and their combination.

Claim 30 recites an apparatus for supercritical processing of a workpiece. The apparatus comprises a hand-off station; a supercritical processing module coupled to the hand-off station, the supercritical processing module having a workpiece cavity and configured to perform supercritical processing on the workpiece within the workpiece cavity; a non-supercritical processing module coupled to the hand-off station; a transfer mechanism coupled to the hand-off station, the transfer mechanism configured to move the workpiece between the entrance, the supercritical processing module, and the non-supercritical processing module; and a circulation line coupled to the supercritical processing module and configured to maintain a supercritical fluid in a supercritical state and to circulate the supercritical fluid through the workpiece cavity. As described above, neither Bok, Ueno, nor their combination teaches or suggests a circulation line coupled to the supercritical processing module and configured to circulate a supercritical fluid along the circulation line and through the workpiece cavity in a supercritical state, as recited in claim 30. For at least this reason, claim 30 is allowable over Bok, Ueno, and their combination.

Within the final Office Action, claims 1, 6-8, 15-17, 19, 20, 25, and 29-33 are also rejected under 35 U.S.C. § 103(a) as being unpatentable over Bok in view of Figure 2-121 of JP 2000106358 to Toru Yasuda ("Yasuda") and also in view of Figure 1 of U.S. Patent No. 5,509,431 to Smith Jr. et al. ("Smith"). The Applicants respectfully disagree with these rejections.

As explained above, Bok does not teach or suggest circulating a supercritical fluid along a circulation line and through a workpiece cavity in a supercritical state. As described below, neither does Yasuda or Smith.

Yasuda is directed to a system for processing semiconductor wafers. The system comprises a processing tub for plasma etching a semiconductor wafer. (Translation of Yasuda, e.g., ¶¶ 0007 and 0024) The system is also configured to clean the processing tub and an enclosed wafer using supercritical fluids. (*Id.*, ¶¶ 0026 and 0030) In Figure 1, cited within the final Office Action, Yasuda further teaches a recycle segment comprising a separation tub 119 and a compressor 121. Along the recycle segment, supercritical fluid and polymeric material are transmitted to the separation tub 119, where the temperature and pressure are adjusted so that the supercritical fluid is returned to a gas from which the polymeric material is extracted. The gas is then transmitted to a compressor 121 and on to the processing tub 100a, where it is again returned to a supercritical state. (*Id.*, ¶ 0028) Thus, a supercritical fluid is not circulated along a circulation loop and through a processing tub in a supercritical state. Furthermore, Yasuda does not teach a chemical rinse and supply arrangement coupled to a circulation line as described in the Specification.

Smith discloses an apparatus for precision cleaning of a workpiece. The apparatus comprises a pressure vessel containing an inner tank. The apparatus comprises a first circulation line for circulating a solvent through the inner tank, and a second circulation line for circulating a liquid or supercritical fluid through the entire pressure vessel. The second circulation line also comprises a liquid CO_2 reservoir and a heat exchanger. Smith teaches that by circulating the solvent through the inner tank and not the entire pressure vessel, the interior walls of the pressure vessel will not be contaminated, and piezeoelectric transducers and other components positioned on the inner walls will not be degraded. Smith teaches that both the first circulation line and the second circulation line are coupled to a separator. When supercritical CO_2 is circulating on the second circulation line, the separator is used to vaporize the supercritical CO_2, returning it to a gas phase, thereby allowing the removal of the liquid solvents and contaminants from the gas CO_2. The gas CO_2 is later returned to the supercritical state either at the heat exchanger or within the pressure chamber. (Smith, col. 4, lines 32-38). Thus, Smith dos not teach circulating a supercritical fluid along a circulation line and through a wafer cavity in a supercritical state. Instead, Smith teaches circulating carbon dioxide along a portion of the second circulation line in a non-supercritical state. Furthermore, Smith does not teach a chemical rinse and supply arrangement coupled to a circulation line as described in the Specification.

Claim 1 is directed to an apparatus for supercritical processing of a workpiece. The apparatus comprises a transfer module having an entrance; a supercritical processing module coupled to the transfer module, the supercritical processing module having a workpiece cavity for holding the workpiece during high pressure processing; a non-supercritical processing module coupled to the transfer module; a transfer mechanism coupled to the transfer module, the transfer mechanism configured to move the workpiece between the entrance, the supercritical processing module, and the non-supercritical processing module; and a circulation line coupled to the workpiece cavity and configured to circulate a supercritical fluid along the circulation line and through the workpiece cavity in a supercritical state. As explained above, neither Bok, Yasuda, nor Smith teaches a circulation line coupled to the workpiece cavity and configured to circulate a supercritical fluid along the circulation line and through the workpiece cavity in a supercritical state, as recited in claim 1. For at least this reason, claim 1 is allowable over Bok, Yasuda, Smith, and their combination.

Claims 6-8, 15-17, 19, 20, 25, 30, 31, and 33 all depend on claim 1. As explained above, claim 1 is allowable over Bok, Yasuda, Smith, and their combination. Accordingly, claims 6-8, 15-17, 19, 20, 25, 30, 31, and 33 are all also allowable as depending on an allowable base claim.

Claim 29 is directed to an apparatus for supercritical processing a workpiece. The apparatus comprises means for transferring the workpiece configured to transfer the workpiece into a transfer module; means for supercritical processing having a workpiece cavity and configured such that in operation the means for transferring transfers the workpiece to the means for supercritical processing and further such that in operation the means for supercritical processing processes the workpiece within the workpiece cavity; means for non-supercritical processing configured such that in operation the means for transferring transfers the workpiece to the means for non-supercritical processing and further such that in operation the means for non-supercritical processing processes the workpiece; and means for circulating a supercritical fluid along the means for circulating and through the workpiece cavity in a supercritical state. As explained above, neither Bok, Yasuda, nor Smith teaches a means for circulating a supercritical fluid along the means for circulating and through a workpiece cavity in a supercritical state, as recited in claim 29. For at least this reason, claim 29 is allowable over Bok, Yasuda, Smith, and their combination.

Claim 30 is directed to an apparatus for supercritical processing of a workpiece. The apparatus comprises a hand-off station; a supercritical processing module coupled to the hand-off station, the supercritical processing module having a workpiece cavity and configured to perform

supercritical processing on the workpiece within the workpiece cavity; a non-supercritical processing module coupled to the hand-off station; a transfer mechanism coupled to the hand-off station, the transfer mechanism configured to move the workpiece between the entrance, the supercritical processing module, and the non-supercritical processing module; and a circulation line coupled to the supercritical processing module and configured to circulate a supercritical fluid along the circulation line and through the workpiece cavity in a supercritical state. As explained above, neither Bok, Yasuda, Smith, nor their combination teaches a circulation line coupled to the supercritical processing module and configured to circulate a supercritical fluid along the circulation line and through the workpiece cavity in a supercritical state, as recited in claim 30. For at least this reason, claim 30 is allowable over Bok, Yasuda, Smith, and their combination.

Within the final Office Action, claims 2-6, 8-10, 19-20, 22-25, and 29-30 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Bok in view of Ueno as applied to claims 1, 6-8, 15-17, 19-20, 25, and 19-33 and further in view of U.S. Patent Number 6,110,232 to Chen ("Chen"). The Applicants respectfully disagree with these rejections.

As described above, claim 1 is allowable over the teachings of Bok. Accordingly, claim 1 is allowable over the teachings of Bok, Ueno, Chen, and their combination.

Claims 2-6, 8-10, 19-20, 22-25, 31, and 33 all depend from claim 1. Accordingly, claims 2-6, 8-10, 19-20, 22-25, and 31, and 33 are also all allowable as depending on an allowable base claim.

Within the final Office Action, claims 11 and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Bok in view of Ueno as applied to claims 1, 6-8, 15-17, 19, 20, 25, and 29-33, and further in view of U.S. Patent No. 6,235,634 to White et al. ("White"). The Applicants respectfully disagree with these rejections.

As explained above, claim 1 is allowable over Bok and Ueno, either alone or in combination. Claims 11 and 12 both depend on claim 1. Accordingly, claims 11 and 12 are allowable as depending on an allowable base claim.

Within the final Office Action, claims 13, 14, 18, and 21 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Bok in view of Ueno as applied to claims 1, 6-8, 15-17, 19, 20, 25, and 29-33, and further in view of U.S. Patent No. 6,077,321 to Adachi et al. ("Adachi"). The Applicants respectfully disagree with these rejections.

As explained above, claim 1 is allowable over Bok and Ueno, either alone or in combination. Claims 13, 14, 18, and 21 all depend on claim 1. Accordingly, claims 13, 14, 18, and 21 are allowable as depending on an allowable base claim.

The new claim 34 is directed to an apparatus for supercritical processing of a workpiece. The apparatus comprises a transfer module having an entrance; a supercritical processing module coupled to the transfer module, the supercritical processing module having a workpiece cavity for holding the workpiece during high pressure processing; a non-supercritical processing module coupled to the transfer module; a transfer mechanism coupled to the transfer module, the transfer mechanism configured to move the workpiece between the entrance, the supercritical processing module, and the non-supercritical processing module; a circulation line coupled to the workpiece cavity and configured to circulate a supercritical fluid along the circulation line and through the workpiece cavity in a supercritical state; and a chemical rinse and supply arrangement coupled to the circulation line. As explained above, none of the prior art, either alone or in combination, teaches a circulation line coupled to the workpiece cavity and configured to circulate a supercritical fluid along the circulation line and through the workpiece cavity in a supercritical state. Furthermore, none of the prior art, either alone or in combination, teaches a chemical rinse and supply arrangement coupled to the circulation line. For at least these reasons, claim 34 is allowable.

Claims 35-37 depend from claim 34. As described above, claim 34 is allowable over the prior art. Accordingly, claims 35-37 are also all allowable as depending on an allowable base claim.

For the reasons given above, the Applicants respectfully submit that claims 1-25 and 29-31, and 33-37 are in a condition for allowance, and allowance at an early date would be appreciated. If the Examiner has any questions or comments, he is encouraged to call the undersigned at (408) 530-9700 so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,

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By: Thomas B. Haverstock

Thomas B. Haverstock
Reg. No.: 32,571
Attorneys for Applicant(s)

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